SUTD Leap

[RE]IMAGINE EDUCATION

A weekly Design AI newsletter

AI AND ARCHITECTURE: BUILDING THE FUTURE

Assistant Professor Immanuel Koh
In Conversation with Dr. Nachamma Sockalingam, OSP

https://www.sutd.edu.sg/profile/immanuel-koh/

In this week's [Re]Imagine Education feature, we spotlight how Assistant Professor Immanuel Koh is challenging architecture students to go beyond tool mastery and engage AI with critical insight and disciplinary depth.

From decoding architectural diagrams to stress-testing language and vision models, his courses foster spatial reasoning and reflective practice at the core of design education.

As AI becomes an integral part of the architect's toolkit, Immanuel's pedagogical approach ensures that students not only learn how to use AI, but also how to question it, critique it, and shape its role in the future of the built environment.

Let's get inspired!

Editor of Newsletter:
Dr. Nachamma Sockalingam, Office of Strategic Planning

Hi Immanuel, welcome to the Reimagine Education conversation. You have a background that spans architecture and artificial intelligence. Sounds very interesting. Tell us about your journey at SUTD.

I joined SUTD in September 2019, right before defending my PhD at EPFL in Lausanne, Switzerland. My PhD was jointly conducted at the Institute of Architecture and the School of Computer Science, focusing specifically on AI in architecture. I was appointed by SUTD ASD to teach AI, and my first course was 'Creative Machine Learning,' an elective I launched in my first term here.

Over the years, I have taught "Artificial Architecture Intelligence in Design," a theory-based course that explores the historical and conceptual underpinnings of intelligent architecture. I am also the Faculty Lead of DAI's Spatial Design Studio, a collaborative studio course that connects students with industry partners on real-world spatial design problems. In addition to all these, I supervise both master's and PhD students working at the intersection of AI and architecture.

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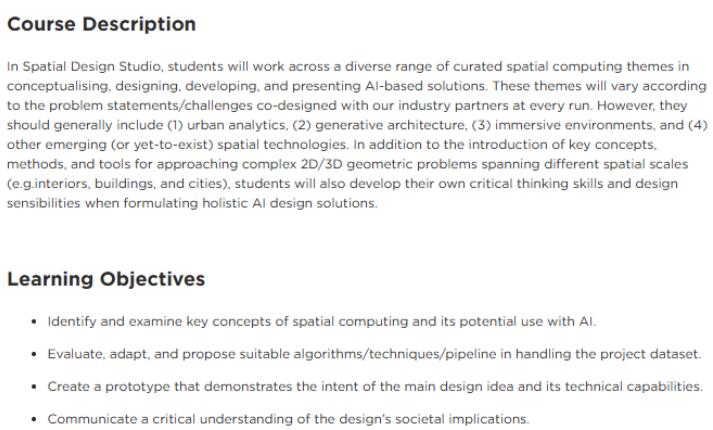
How do your courses integrate AI and architecture? Can you highlight some key modules you've designed or taught?

'Creative Machine Learning' is a hands-on course where students learn to code, train neural networks, and evaluate their models. When I started in 2019, students had to manually install libraries and code everything from scratch," he recalls. "Today, we also leverage visual programming tools as well as natural language-driven / vibe coding."

He adds, "There's also 'Artificial Architecture Intelligence in Design,' a more theoretical course aimed at term-eight students. It emphasizes critical thinking and historical grounding, tracing how ideas about intelligent buildings have evolved since the 1960s."

A third course, 'DAI Spatial Design Studio' is interdisciplinary and open to non-DAI students such as ASD. "It runs in term seven and involves collaborations with up to eight different industry partners, ranging from AI-driven urban planning to AI-assisted museum curation ," says Dr. Koh.



Course Description

In Spatial Design Studio, students will work across a diverse range of curated spatial computing themes in conceptualising, designing, developing, and presenting AI-based solutions. These themes will vary according to the problem statements/challenges co-designed with our industry partners at every run. However, they should generally include (1) urban analytics, (2) generative architecture, (3) immersive environments, and (4) other emerging (or yet-to-exist) spatial technologies. In addition to the introduction of key concepts, methods, and tools for approaching complex 2D/3D geometric problems spanning different spatial scales (e.g.interiors, buildings, and cities), students will also develop their own critical thinking skills and design sensibilities when formulating holistic AI design solutions.

Learning Objectives

- Identify and examine key concepts of spatial computing and its potential use with AI.
- Evaluate, adapt, and propose suitable algorithms/techniques/pipeline in handling the project dataset.
- Create a prototype that demonstrates the intent of the main design idea and its technical capabilities.
- Communicate a critical understanding of the design's societal implications.

Generative AI has taken center stage recently. How are you incorporating GenAI in your classrooms?

Every term, I adjust my courses based on emerging AI technologies. This term, I emphasized visual programming using open-source tools that integrate well with ASD's design computation courses. My students work with GenAI tools to generate outputs using workflows like text-to-image, image-to-video, image-to-sound, and image-to-image.

For the first time, there coding is optional. Instead, I focus on logical thinking—how to connect models, how to identify which components should be changed to achieve a desired effect. That hands-on approach helps students understand what's happening beneath the surface. It's not just plug and play; they learn to ask questions like: What does this parameter mean? Why am I adjusting the noise value? What's the impact of a random seed?

This course is experimental by nature—it evolves each term in response to how quickly the technology is changing.

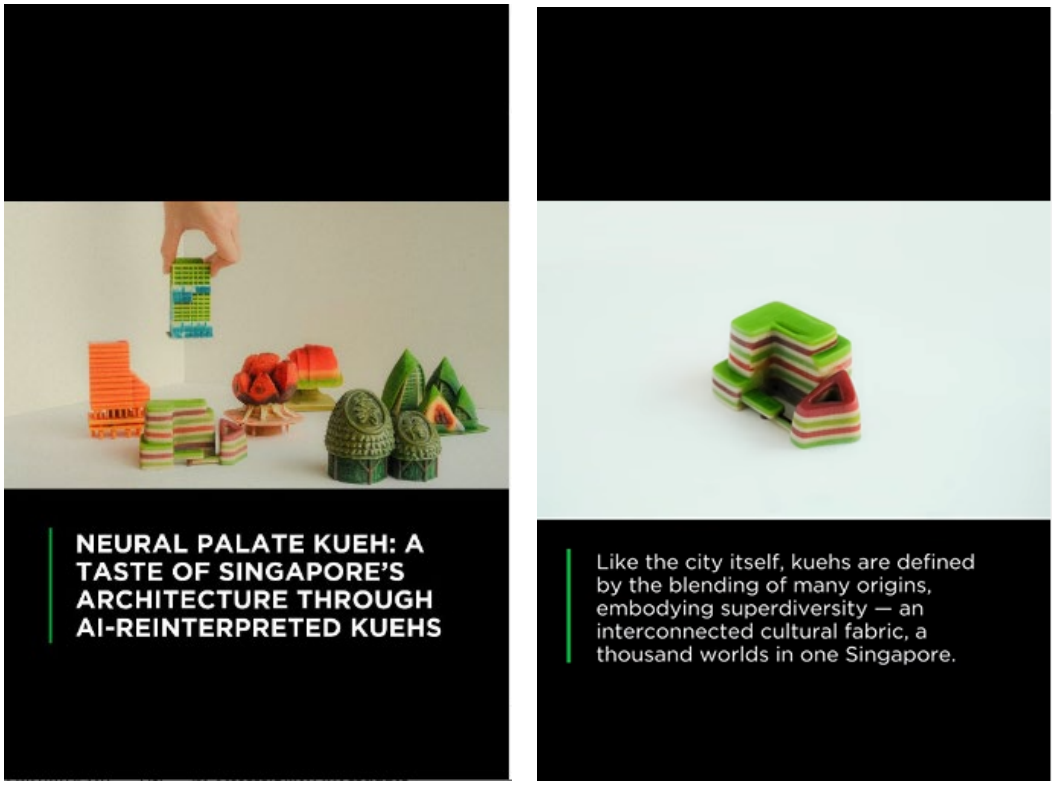
My students also train their own models on custom datasets to align outputs more closely with their design intentions. This is the only course where architecture students actually train their own models with their own training sets, customizing their outputs to better match their design goals.

How do you localize AI applications in architecture education at SUTD?

As part of the Creative Machine Learning course, I created a small exercise linked to the Singapore Pavilion at this year's Venice Architecture Biennale. The theme, "Rasa-Tabula-Singapura," plays on "Tabula Rasa" but adds a local flavor—"rasa" meaning taste in Malay.

I asked students to document how people dine in Singapore—from Kueh to BBQ. They used AI tools to generate new narratives from their original video footages in reflecting our multicultural food scene.

Eventually, some of these works were featured in the Pavilion. This exercise helped ground typically-generic AI methods in a uniquely Singaporean context, allowing students to connect their designs with local culture and narratives.



Do you see AI as a "cool tool" or a "teammate" in your students' creative journey?

It really depends on the kind of AI we're talking about. With non-agentic tools—where students still control the workflow and choose what outputs to accept—AI remains a tool. These tools don't make decisions or initiate actions on their own; they execute specific tasks when prompted.

But with agentic AI, where autonomous agents can respond to prompts with some degree of reasoning, we start to approach a co-creator or teammate model. These systems can chain thoughts, generate new ideas, and interact in a goal-directed way, often without needing step-by-step instructions. For example, if a large language model (or models) is used in an autonomous manner to complete a design task, that would qualify as agentic AI.

In short, referring to the original question, I foresee

"AI as cool teammates using cool tools."

(Reference: For further explanation of agentic AI, see Stanford HAI's overview on AI agency at hai.stanford.edu.)

How do you cultivate critical thinking around AI rather than just tool proficiency?

That's a key part of my course, *Artificial Architecture Intelligence in Design*. This term, we focused on architectural diagrams as a form of architectural reasoning—essentially, the capacity to understand, interpret, simulate, and manipulate the designed relationships among objects and spaces.

I had students collect 10–20 diagrams from global architecture firms and develop test questions for various large language models. They then created their own diagrams to test AI models with entirely novel inputs—not to generate outputs, but to evaluate whether the AI could grasp and reason through architectural logic.

I asked them to test different vision-language models. Some even ran their own open-source models. Through this, they reflected (perhaps implicitly) deeply on what's core to our discipline: spatial reasoning as both a visual language and a cognitive tool for design.

In one project, students created GPT-style chatbots and prompted them with architecture theory questions, comparing the coherence and depth of responses. They were stunned at how differently each model performed on the same prompt. That alone was a critical learning moment about model architecture and training bias.

What's the broader learning outcome you hope your students take away from these AI-integrated courses?

Ultimately, I want them to be reflective practitioners. They shouldn't just know how to use the tools—but also when and why. They need to understand the assumptions baked into these models and be capable of questioning their outputs.
Whether they use AI to co-create, to critique, or to innovate, the key is that they remain aware of the evolving landscape and are prepared to navigate it with both technical skill and critical insight. Education, after all, isn't just about acquiring skills—it's about cultivating thoughtful, adaptive, and ethically minded designers.

Finally, how do you see the future of architecture shaped by AI—and your students' role in it?

AI won't replace architects as long as architects intelligently redefine their roles as well as realign the development of future AI. My job is to make sure my students are capable of the former and ideally the latter.